LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications

A Latent Virus in Sugar-beets and Mangolds

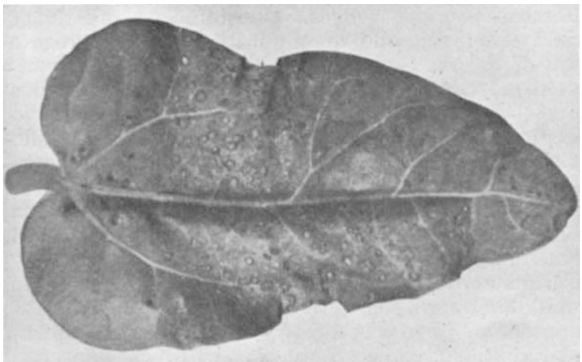
In a previous communication[1], a short description was given of a new virus isolated from a steckling mangold. Further investigation has revealed the interesting fact that this virus seems to be present in a latent condition in a high percentage of the ordinary seed beets and mangolds in the British Isles. Samples of apparently healthy sugar-beet and mangold stecklings collected at random from different farms in Essex, Cambridge, Lincoln and Scotland were all found to contain the virus. The concentration of virus differed considerably in the various lots, and the virus was not detected in every plant of each sample.

The presence of the virus can be rapidly demonstrated by inoculation of the sap to the first leaves of cowpea seedlings (see photograph), which results in the production of characteristic lesions. This method of testing also reveals clearly the differences in the concentration of virus in the samples. In some mangold stecklings the virus was in such low concentration that only one or two lesions would develop on the leaves of the cowpea. On the other hand, the virus concentration, especially in sugar-beet, would sometimes be sufficient to destroy the leaves of the test plant.

The virus appears to be very unstable. Although it may occur in high concentration, all attempts to isolate it by chemical means have failed, and it seems to be inactivated by high-speed centrifugation. The thermal inactivation point is very low, about 40° C., and the longevity *in vitro* is also short. Probably for these reasons it has not been possible to prepare an antiserum to it.

Since the virus is so widely distributed, it would appear, unless it is seed-transmitted, that there must be a common insect vector. So far, however, insect transmission tests have all failed.

The presence of latent or 'silent' viruses in plants and other organisms is not, of course, new. There are other examples in plants, and there seems little doubt that viruses are latent in a high percentage of apparently healthy caterpillars[2]. It is, however, unusual to find a symptomless virus so widespread as this one appears to be. At the moment, it seems to be innocuous to the sugar-beet crop; but its presence must nevertheless be regarded as a potential source of danger.



Leaf of cowpea inoculated from an apparently healthy sugar-beet, showing the lesions produced by the latent virus

KENNETH M. SMITH

Plant Virus Research Unit,
Agricultural Research Council,
Molteno Institute,
Cambridge.

May 4.

[1] Smith, Kenneth M., *Research*, 3 (1950).
[2] Smith, Kenneth M., and Wyckoff, R. W. G., *Research*, 4, 148 (1951).

'Excessive Dose' Phenomenon in Virus Infections

It has often been observed that the administration to a susceptible host of an excessive infecting dose of virus may be followed by a reaction of considerably less intensity than that induced by a normal or small infecting dose[1]. This has been variously attributed to the presence of antibodies in the larger inoculum, or to the fact that attenuated or non-virulent particles[2,3] interfere with the development of the normal particles.

During an investigation of the interaction of *Salmonella typhi-murium* and certain of its symbiotic bacteriophages, particularly those of group A[4], an analogous phenomenon has been observed which has some bearing on this problem.

When cultures of an indicator organism growing in a liquid medium are exposed to different concentrations of type $A1$ phage particles, turbidity curves follow an unexpected course. Whereas in the case of a true lytic phage, such as one of the anti-O phages, a high initial concentration of particles (that is, excessive infecting dose) merely accelerates the onset of lysis, a similar concentration of type $A1$ phage causes bacterial growth to lag a little behind that of a normal phage-free culture of the bacteria but produces no obvious lysis. With both types of phage, when there is a low concentration of particles, a period of bacterial growth is followed by a sudden mass lysis. Furthermore, when the initial phage $A1$/bacteria ratio is high, there is but little increase in concentration of particles, while a high titre is reached in the culture with a low infecting dose.

If the growth-curve can be taken as an index of the 'well-being' of the organism, these results have all the characters of the 'excessive dose' effect as produced by certain animal viruses.

The immediate cause of this phenomenon has been definitely established. When bacteria are exposed to an excess of type $A1$ phage particles, a high percentage become symbiotically infected and so continue to multiply without significant lysis. On the other hand, when the ratio of phage particles to bacteria is low, symbiotic infection is infrequent; phage multiplies by the lytic cycle, the uninfected bacteria dividing normally until phage concentration overtakes bacterial concentration, when mass lysis occurs.

The underlying cause—the principle which determines whether phage infection shall result in symbiosis or lysis—is less certain. It may be that the invasion of a bacterium by more than one particle leads to the development of the symbiotic state; but it is difficult to understand how this would operate, or why it should apply to some phages (the symbiotic types) and not to others (the lytic types).